



**UNITED STATES DEPARTMENT OF COMMERCE**  
**Patent and Trademark Office**

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/473,394	12/28/99	MISTRY	K 042390.P6892

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EXAMINER

KANG, D

ART UNIT

PAPER NUMBER

2811

DATE MAILED:

11/01/01

**Please find below and/or attached an Office communication concerning this application or proceeding.**

**Commissioner of Patents and Trademarks**

**Office Action Summary**

Application No.

09/473,394

Applicant(s)

MISTRY, KAIZAD R.

Examiner

Donghee Kang

Art Unit

2811

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 13 August 2001.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-9 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-9 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Acknowledgement*

1. Applicant's Amendment and Response to Paper No.7 have been entered and made of Record. Claims 1-9 are pending in this office action.

### *Claim Rejections - 35 USC § 102*

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

3. Claims **1-3** are rejected under 35 U.S.C. 102(e) as being anticipated by Chang et al. (US 6,303,448).

Chang et al. discloses a field effect transistor comprising (Fig. 6):

a substrate (10) having a recess in a surface thereof, the recess having a bottom portion and substantially vertical wall; a gate dielectric layer (62) disposed the bottom portion of the recess and adjacent the substantially vertical sidewalls; a gate electrode (64A) overlying the gate dielectric layer, wherein the gate electrode conforms to the recessed channel; and source/drain terminals (70) disposed in the substrate in alignment with a pair of laterally opposed gate electrode sidewalls, wherein the source/drain terminal have an extension (LDD) which extends to a more shallow depth within the substrate than the source/drain terminals to which it corresponds and extends

downwardly, from approximately the surface of the substrate, along the curvilinear sides of the recess; a portion of the gate electrode that overlies an innermost portion of the source/drain extension.

4. Claim 7 is rejected under 35 U.S.C. 102(b) as being anticipated by Hsu (US 5,448,094).

Hsu discloses a field effect transistor comprising (Fig. 2G):

a substrate (20) having a recess in a surface thereof, the recess having a curvilinear recess; a gate dielectric layer (27) disposed the curvilinear recess; a gate electrode (28a) overlying the gate dielectric layer; and source/drain terminals (30) disposed in the substrate in alignment with a pair of laterally opposed gate electrode sidewalls, wherein the source/drain terminal have an extension (31) which extends to a more shallow depth within the substrate than the source/drain terminals to which it corresponds and extends downwardly, from approximately the surface of the substrate, along the curvilinear sides of the recess.

***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 4-6 & 8-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hwang (US 5,567,966) in view of Hsu (US 5,448,094).

Regarding claim 4, Hwang discloses a field effect transistor comprising (Fig. 6):  
a substrate having a recess in a surface thereof, the recess having a bottom portion and tapered sidewalls, the tapered sidewall surface forming an obtuse angle with respect to the bottom portions of the recess; a gate dielectric layer disposed the bottom portion of the recess and adjacent the tapered sidewalls; a gate electrode overlying the gate dielectric layer; and source/drain terminals (24) disposed in the substrate in alignment with a pair of laterally opposed gate electrode sidewalls, wherein the source/drain terminal have an extension (22) which extends downwardly, from approximately the surface of the substrate, along the sidewalls of the recess. Hwang does not teach the extension extends to a more shallow depth within the substrate than the source/drain terminals to which it corresponds.

Electric fields tend to be increased at small geometries, since device voltages are difficult to scale to arbitrarily small values. As a result, various hot carrier effects appear in short-channel devices. It is well known in the art that the lightly doped drain (LDD) structure decreases the field between the drain and channel regions, thereby reducing injection into the oxide, impact ionization, and other hot electron effects. The LDD uses two doping levels, with heavy doping over most of the source and drain areas but with light doping in a region adjacent to the channel where the depth of heavily-doped region can be made somewhat greater than lightly-doped region without adversely impacting the device operation and gate electrode overlies an innermost portion of the source/drain extension since it is further away from the channel and also taught by Hsu this limitation in Fig.2G. The increased junction depth lowers both the sheet resistance

and the contact resistance of the drain. Hence it would have been obvious to one having ordinary skill in the art at the time the invention was made to combine the teaching of Hsu with Hwang's device to have the shallow lightly-doped region since it absorbs some of the potential into the drain and thus decreases the electric field.

Regarding claims 5-6 & 8-9, Hwang discloses a portion of the gate electrode overlies an innermost portion of the source/drain extension, wherein the gate electrode conforms to the recessed channel.

#### ***Response to Arguments***

7. Applicant's arguments with respect to claims 1-9 have been considered but are moot in view of the new ground(s) of rejection.

#### ***Conclusion***

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

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9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Donghee Kang whose telephone number is 703-305-9147. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 703-308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Donghee Kang, Ph.D.  
October 23, 2001

Steven Loke  
Primary Examiner

